Computing Systems: Next Call for Proposals

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European Commission
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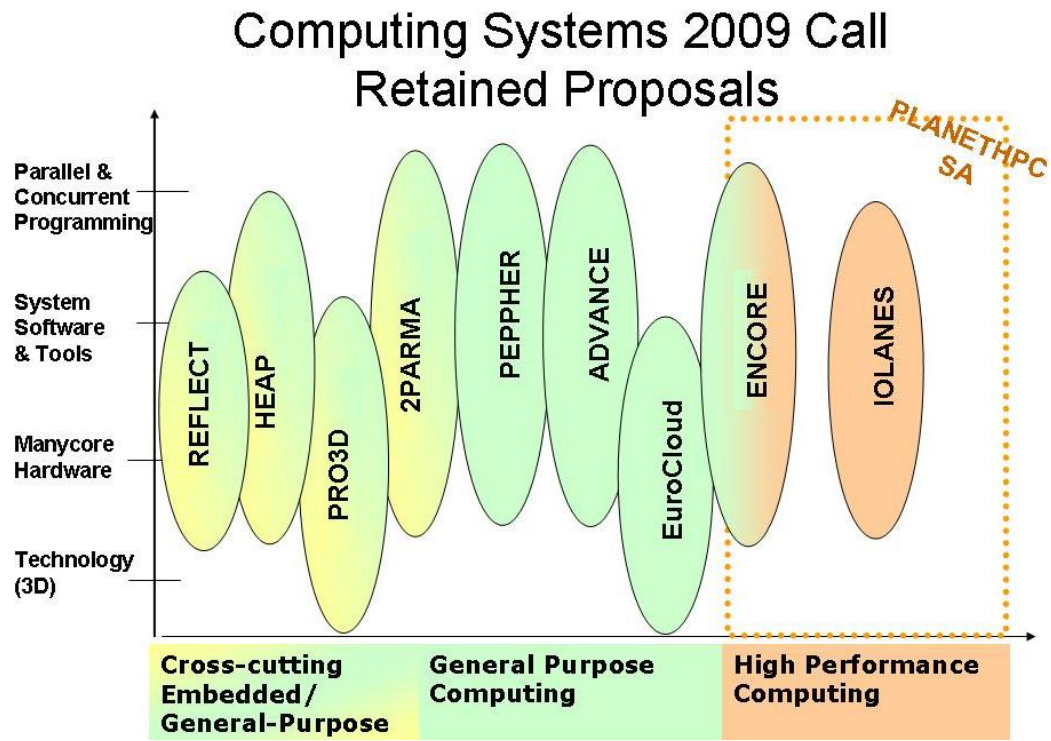
Computing Research: Background

Previous Call



Next Call: Motivations

1. Transition to multicore architectures across the whole computing spectrum [embedded, general-purpose (PC/servers but also smartphones) and high-performance computing (HPC)]
2. Leverage on the strong European position in embedded computing in order to improve the European position in general-purpose and high-performance computing.

Next Call Preparation

- Input from:
  - Consultation workshops cordis.europa.eu/fp7/ict/computing/events_en.html
    - 25 June 2009 on Analysing European Success in Computing Systems Research
    - 29 September 2009 on Virtualisation
    - 16-17 November 2009 on Computing Systems overall
    - 14 December 2009 on high-performance computing
  - Analysis of previous Call results and project achievements
  - HIPEAC NoE research vision
  - Member states and FP7 associated states

Overview of research topics in next call

a) Parallel & Concurrent Computing
   - Multicore, multichip (beyond single-chip)
   - Parallel/concurrent software & tools

b) Virtualisation
   - Heterogeneous multicore systems

c) Customisation
   - Reconfigurable architectures
   - Multicore on single-chip
   - Tool-chains
   - System modelling & simulation

d) Architecture & Technology
   - 3D stacking
   - Alternative computation models

e) International collaboration

BUDGET: 45m

Significantly increased budget reflects the importance of the multicore transition

Instruments:
a)-d): STREPs, NoE
e) CSAs

a) Parallel and Concurrent Computing

- Automatic parallelisation, new high-level parallel & concurrent programming languages and/or extensions to existing languages (including their runtime implementation) that provide portable performance taking into consideration that user uptake is a crucial issue.
- Projects should go beyond on-chip, off-chip boundaries addressing the challenges of programming, testing, verification and debugging, performance monitoring and analysis, low-power and power management especially for large scale parallel systems and data centres, and heterogeneous and accelerator-based multi-core systems.
- Research priorities include:
  - domain-specific languages;
  - concurrent algorithms and transformation of concurrency to parallelism through adaptive compilers and runtime systems;
  - new verification and optimisation environments for parallel software;
  - efficient execution exploiting heterogeneous cores;
  - new approaches to scalability of high-performance computing application codes.

b) Virtualisation

- Virtualisation technologies that are ensuring task isolation and optimised resource allocation as well as guaranteeing performance, timing and reliability constraints.
- The focus is on full virtualisation solutions for heterogeneous multicore platforms including the design of virtualisation-ready heterogeneous multicore hardware platforms and support for accelerator virtualisation.

(c) Customisation

- Unifying hardware design and software development with emphasis on rapid discovery and production of optimal customisations of heterogeneous single-chip multicore systems and associated tool-chains for particular applications.
- Research priorities include:
  - reconfigurable, flexible, soft or hybrid architectures and instruction sets;
  - automatic tool-chain generation;
  - system modelling and simulation, including performance predictability;
  - efficient exploration of the customisation space;
  - low-power and customisation for power efficiency;
  - parallel programming for single-chip multicore architectures;
  - architectural and system-level reliability techniques to counter increasingly probabilistic behaviour of transistors in lower geometries.

d) Architecture and Technology

- The focus is on the impact of next-generation chip fabrication technology on system architectures, tools and compilers.
- Research areas include:
  - implications of 3D stacking;
  - alternative (non von Neumann) models of computation.
- The key challenge is to bridge parallel computing architectures and chip fabrication technology.

e) International Collaboration

- The purpose is to analyse international research agendas and to prepare concrete initiatives for international collaboration for all topics of the objective, in particular with:
  - USA,
  - India,
  - China
  - Latin America
- Separate proposals per geographic area are expected.

Only CSAs !

Expected impacts

- Drastically improved programmability of future parallel multicore/multichip computing systems, providing efficient execution and portable performance of codes on a large variety of computing platforms
- Efficient and ubiquitous use of virtualisation for heterogeneous multi-cores.
- Accelerated system development and production, enabling new products to be realised with a considerably shorter time-to-market.
- Reinforced European excellence in multi-core computing architectures, system software and tools.
- Strengthened European leadership in cross-cutting technologies that are applicable to different market segments of computing systems and, in particular, European leadership in parallel computing systems for large data centres.

More information:

Computing Systems Research Objective

- cordis.europa.eu/fp7/ict/computing/home_en.html
- ***Events and Consultation Workshops:*** cordis.europa.eu/fp7/ict/computing/events_en.html

Computing Systems session in ICT2010 Brussels

http://ec.europa.eu/information_society/events/ict/2010/index_en.htm

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